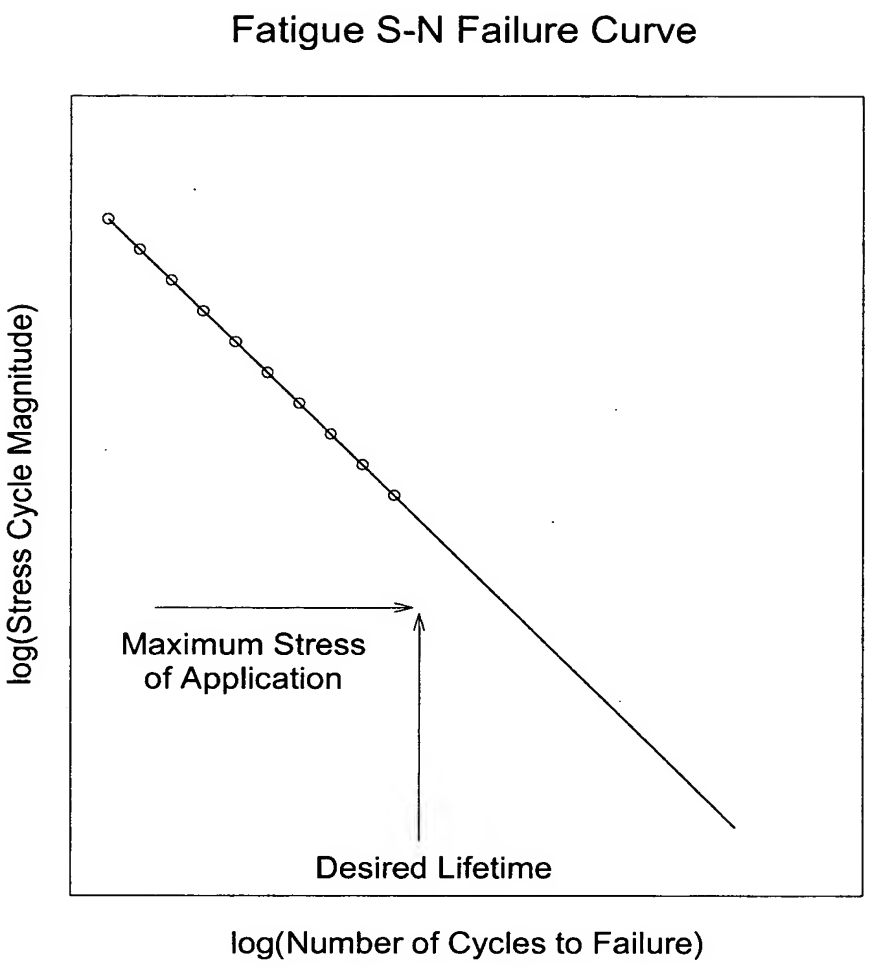
Fig. 1


Fatigue S-N Failure Curve
log(Stress Cycle Magnitude)
Maximum Stress
of Application
Desired Lifetime
log(Number of Cycles to Failure)

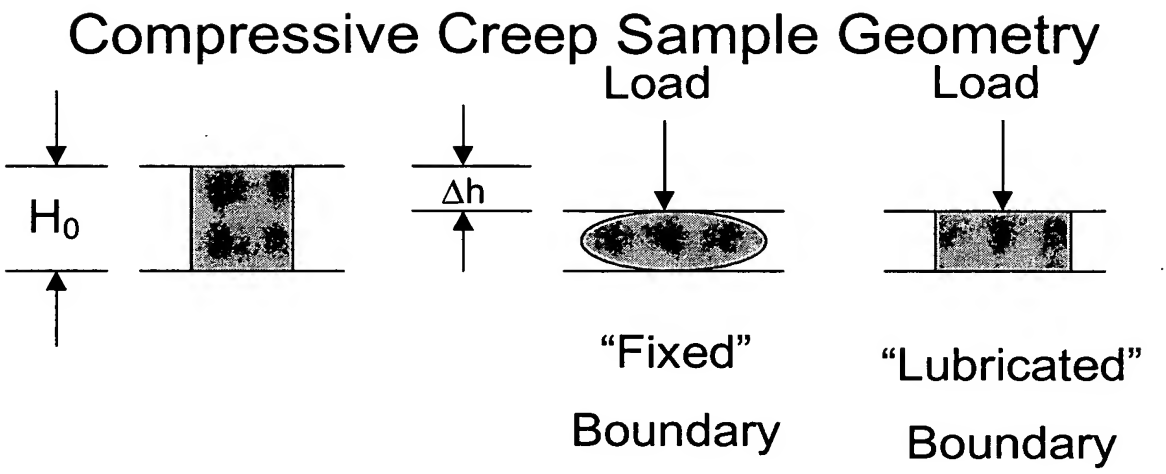
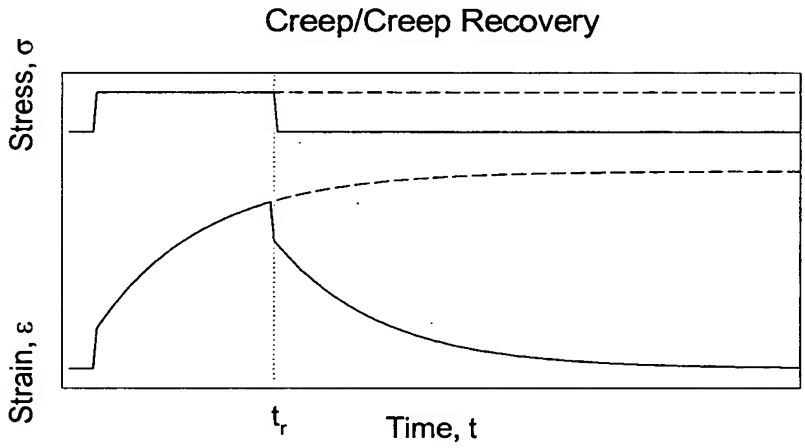


Fig. 2



$\varepsilon = \Delta h/H_0$; σ = Load/Area

$\varepsilon(t) = D(t)\,\sigma$

Fig. 3

Fig. 4

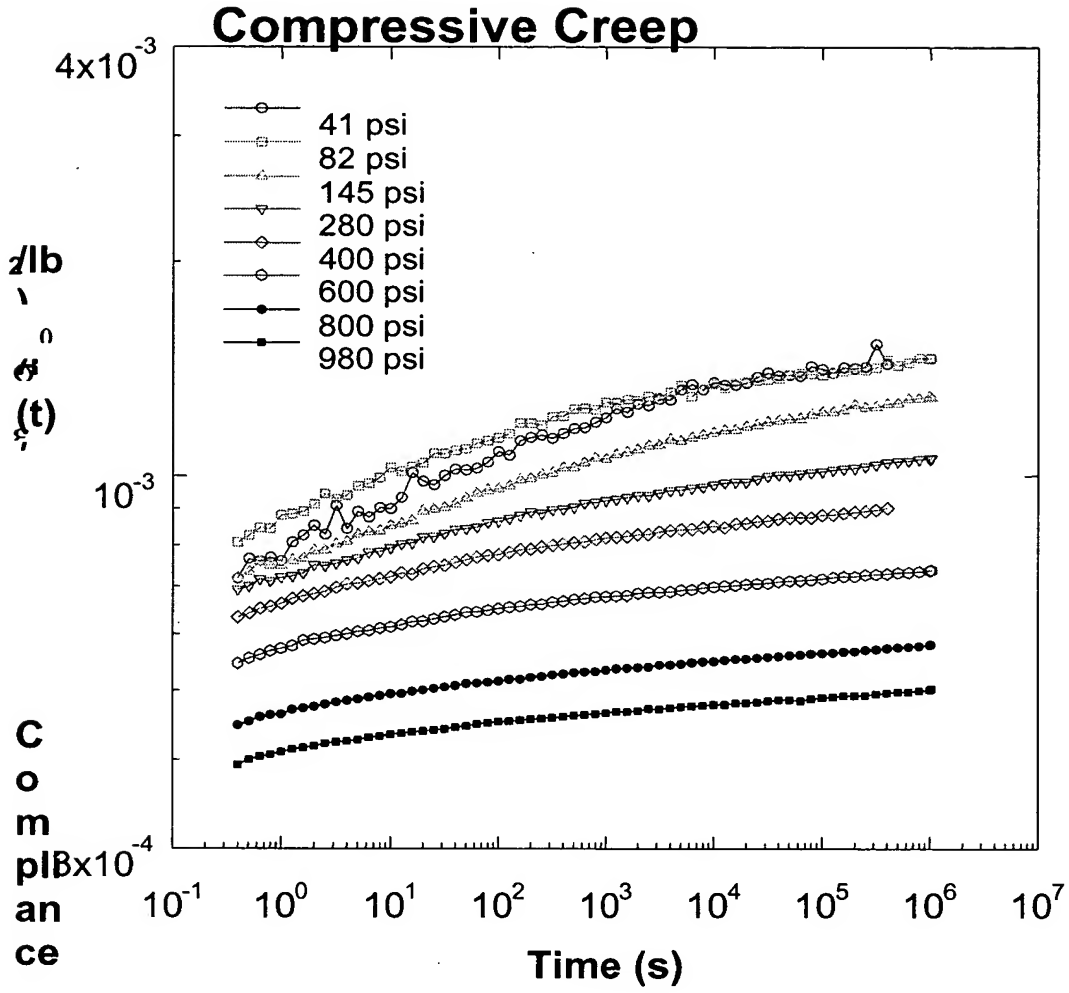

Compressive Creep
4x10^-3
10^-3
8x10^-4
41 psi
82 psi
145 psi
280 psi
400 psi
600 psi
800 psi
980 psi
Compliance
Time (s)
10^-1
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7

Fig. 5

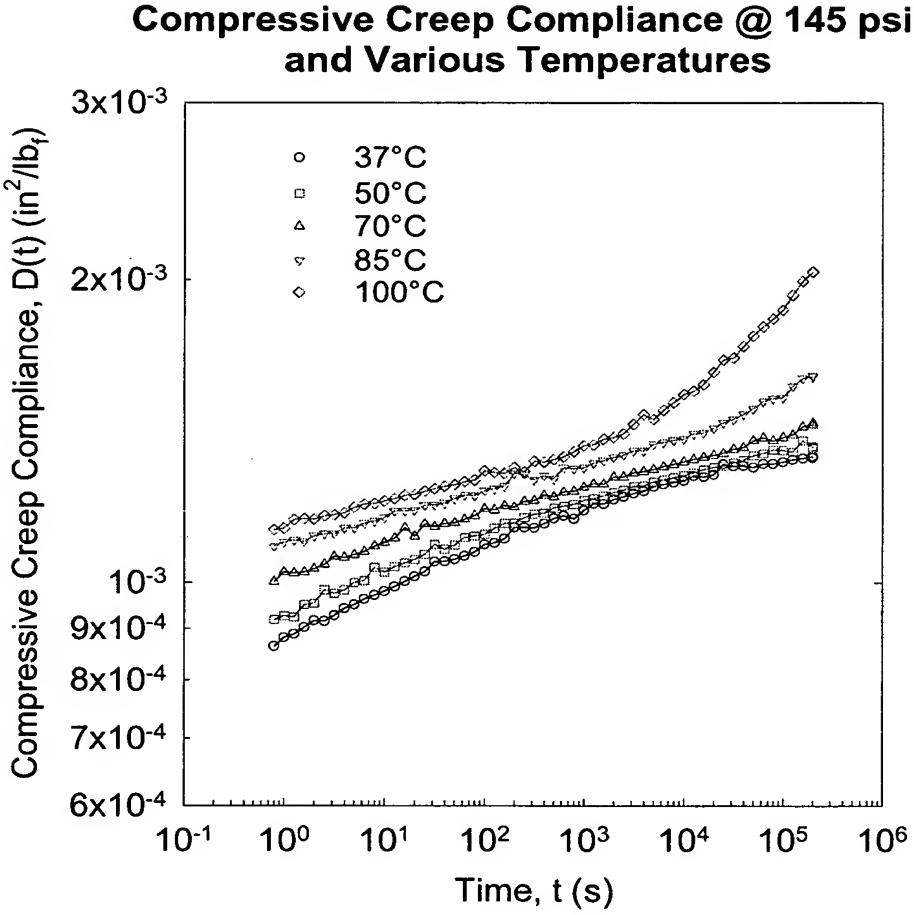

Compressive Creep Compliance @ 145 psi
and Various Temperatures
Compressive Creep Compliance, D(t) (in²/lbf)
3x10-3
2x10-3
10-3
9x10-4
8x10-4
7x10-4
6x10-4
37°C
50°C
70°C
85°C
100°C
10-1
100
101
102
103
104
105
106
Time, t (s)

Fig. 6

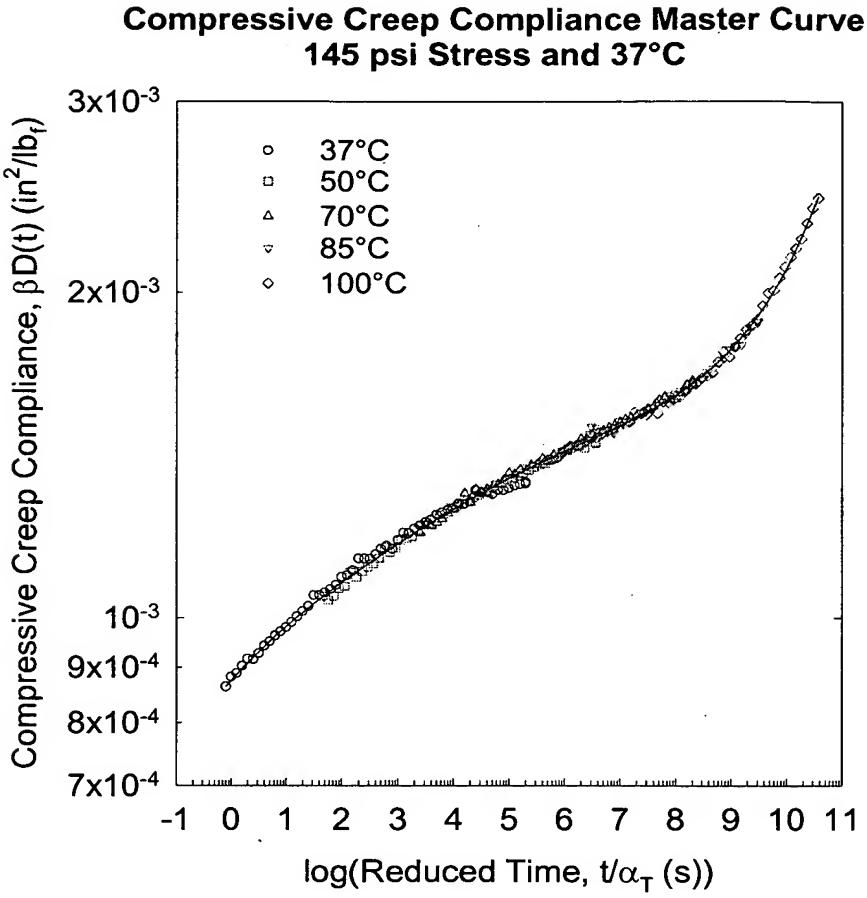
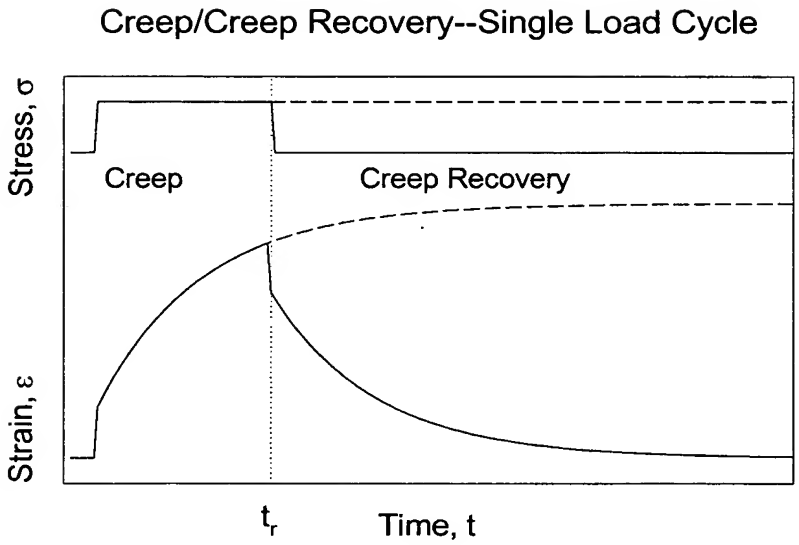

Compressive Creep Compliance Master Curve
145 psi Stress and 37°C
Compressive Creep Compliance, βD(t) (in²/lbf)
3x10-3
2x10-3
10-3
9x10-4
8x10-4
7x10-4
37°C
50°C
70°C
85°C
100°C
-1 0 1 2 3 4 5 6 7 8 9 10 11
log(Reduced Time, t/αT (s))

Fig. 7



$\varepsilon(t) = \sigma_1 D(t)$ Creep Phase

$\varepsilon(t) = \sigma_1 D(t) - \sigma_1 D(t-t_r)$ Recovery Phase

Fig. 8

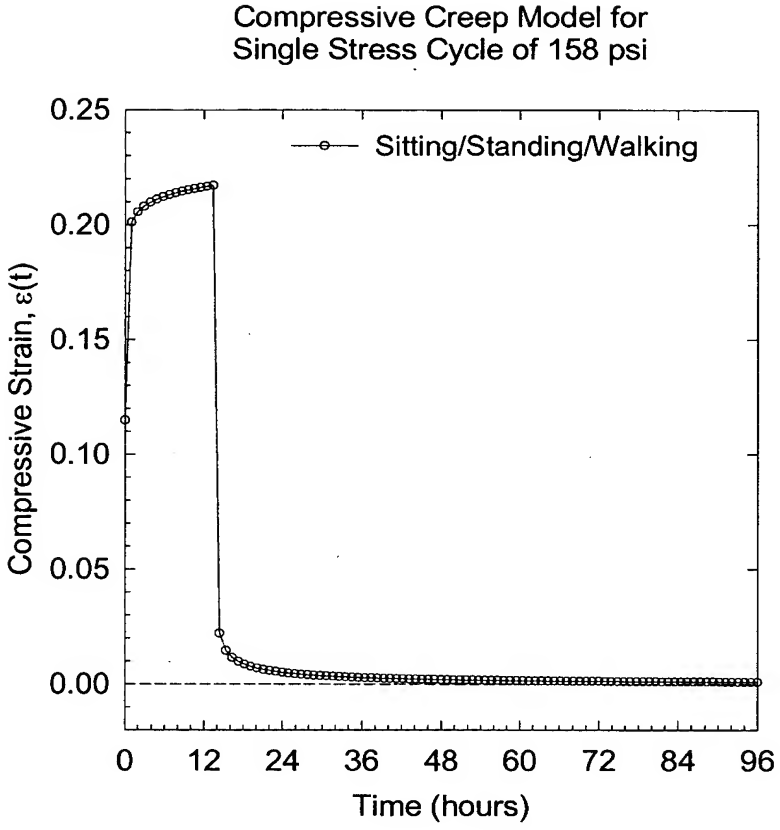

Compressive Creep Model for
Single Stress Cycle of 158 psi
Sitting/Standing/Walking
Compressive Strain, ε(t)
0.25
0.20
0.15
0.10
0.05
0.00
0
12
24
36
48
60
72
84
96
Time (hours)

Fig. 9

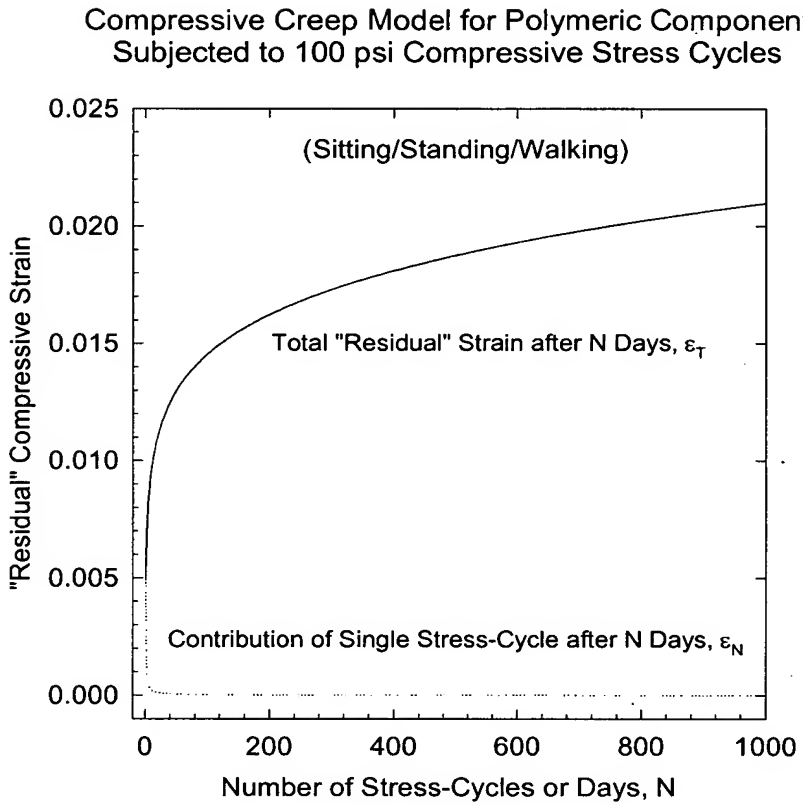

Compressive Creep Model for Polymeric Component
Subjected to 100 psi Compressive Stress Cycles
(Sitting/Standing/Walking)
Total "Residual" Strain after N Days, ε_T
Contribution of Single Stress-Cycle after N Days, ε_N
"Residual" Compressive Strain
0.025
0.020
0.015
0.010
0.005
0.000
0
200
400
600
800
1000
Number of Stress-Cycles or Days, N

Fig. 10

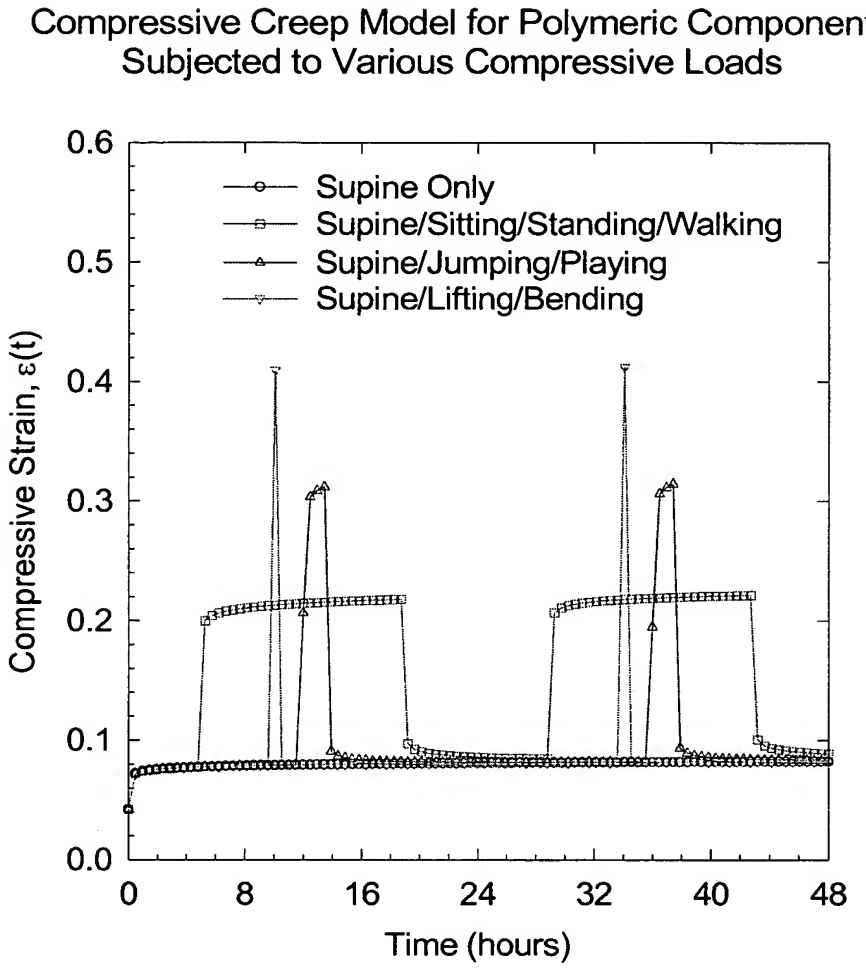

Compressive Creep Model for Polymeric Component
Subjected to Various Compressive Loads
Supine Only
Supine/Sitting/Standing/Walking
Supine/Jumping/Playing
Supine/Lifting/Bending
Compressive Strain, ε(t)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
8
16
24
32
40
48
Time (hours)

Fig. 11

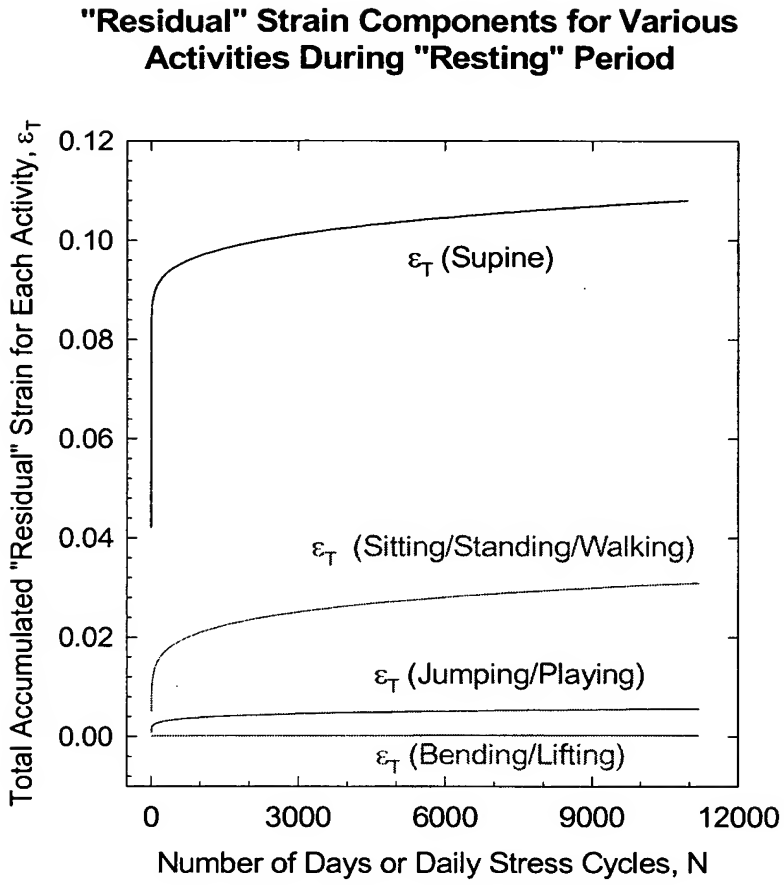
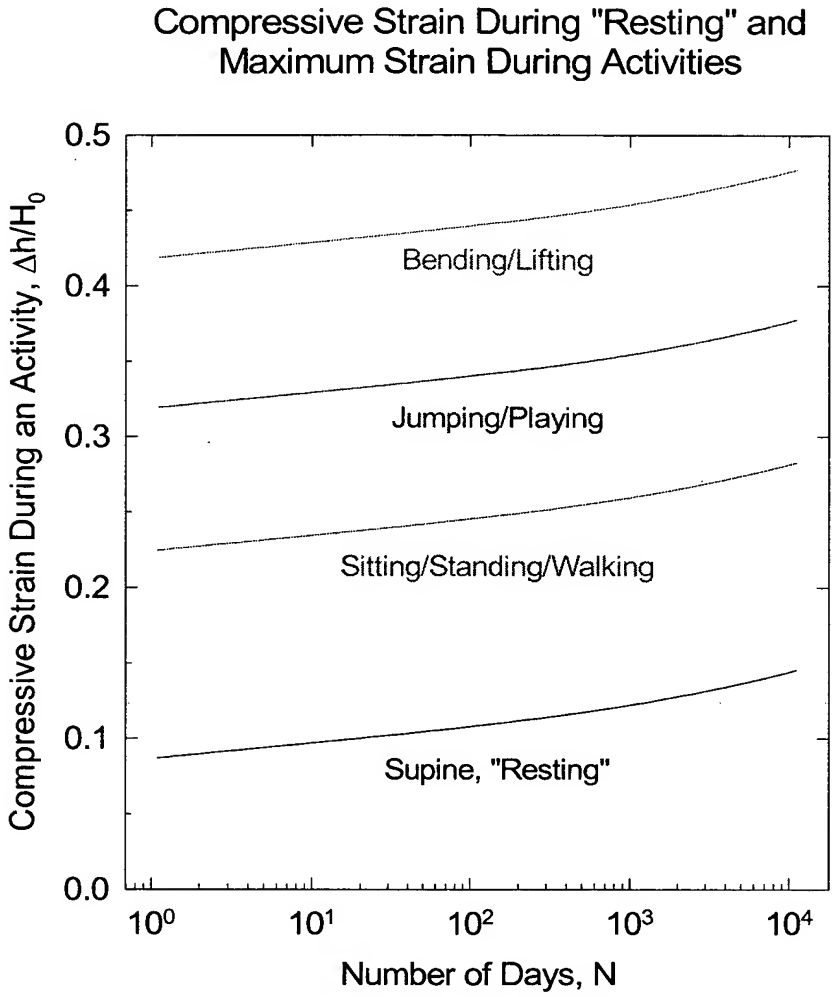

"Residual" Strain Components for Various Activities During "Resting" Period
Total Accumulated "Residual" Strain for Each Activity, ε_T
0.12
0.10
0.08
0.06
0.04
0.02
0.00
ε_T (Supine)
ε_T (Sitting/Standing/Walking)
ε_T (Jumping/Playing)
ε_T (Bending/Lifting)
0
3000
6000
9000
12000
Number of Days or Daily Stress Cycles, N

Fig. 12


Compressive Strain During "Resting" and
Maximum Strain During Activities
Compressive Strain During an Activity, $\Delta h/H_0$
0.5
0.4
0.3
0.2
0.1
0.0
Bending/Lifting
Jumping/Playing
Sitting/Standing/Walking
Supine, "Resting"
10^0
10^1
10^2
10^3
10^4
Number of Days, N